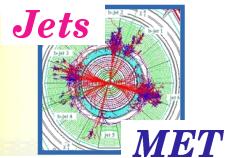




INCLUSIVE SUSY TRIGGER @ $2 * 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$

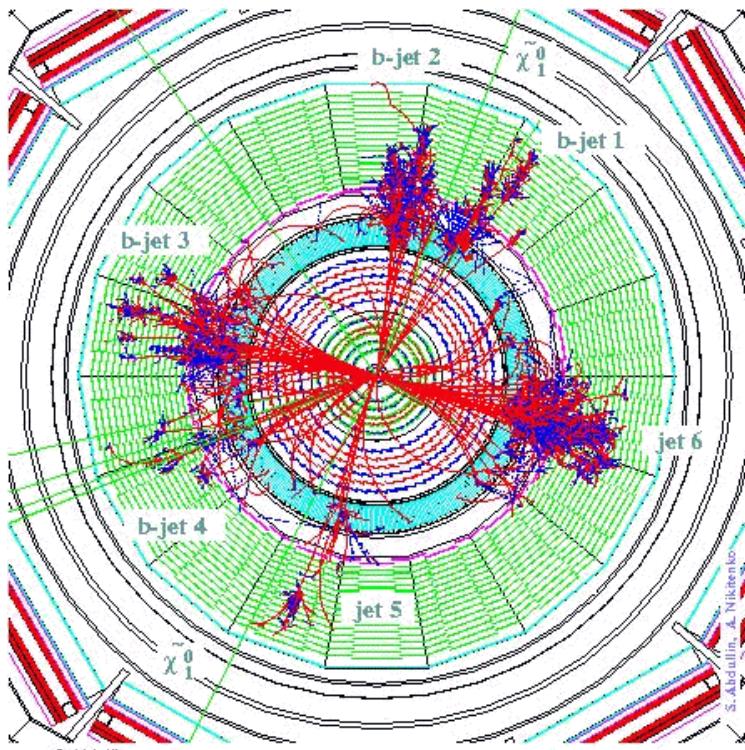
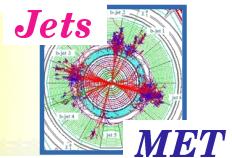


Salavat Abdullin, UMD

- What's the SUSY from Jets/MET point of view
- Probing points
- Calculational details
- L1 signal selection
- L2 signal efficiency vs QCD rate



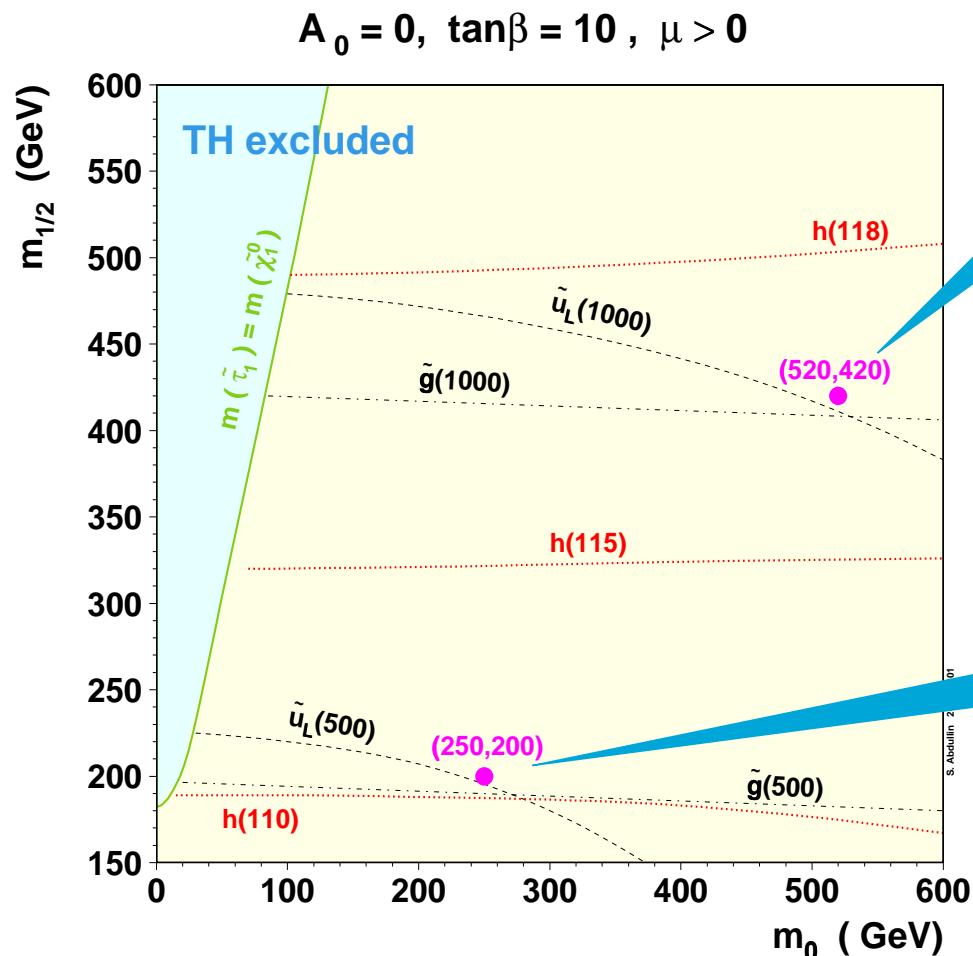
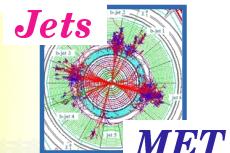
GENERIC SUSY



- Multijet + (leptons) + E_T^{miss} events
- Two mSUGRA points are available for low-lumi study
 - $M_{\text{SUSY}} \sim 500$ GeV (beyond Tevatron II reach)
~ 1000 GeV
 - $m(\tilde{g}) \approx m(\tilde{q})$
 - $\tan \beta = 10$ ("preferred")
 - $\mu > 0$ - the sign doesn't play a big role,
though positive one is favoured by g-2
"indirect" constraint - anomalous
magnetic momentum of muon



PROBING POINTS



$$m(\tilde{\chi}_1^0) = 177.5 \text{ GeV} \quad m(h) = 116.8 \text{ GeV}$$

$$m(\tilde{t}_1) = 726 \text{ GeV}$$

$$\sigma = 2.24 \text{ pb}, \text{ requires } \int L dt < 100 \text{ pb}^{-1}$$

typical cuts :

② $E_T > 300 \text{ GeV}, N_j \geq 4$

$E_T^j > 200, 100, 50 \text{ GeV}$

$$m(\tilde{\chi}_1^0) = 79.0 \text{ GeV} \quad m(h) = 110.7 \text{ GeV}$$

$$m(\tilde{t}_1) = 352 \text{ GeV}$$

$$\sigma = 115 \text{ pb}, \text{ requires } \int L dt < 10 \text{ pb}^{-1}$$

typical cuts :

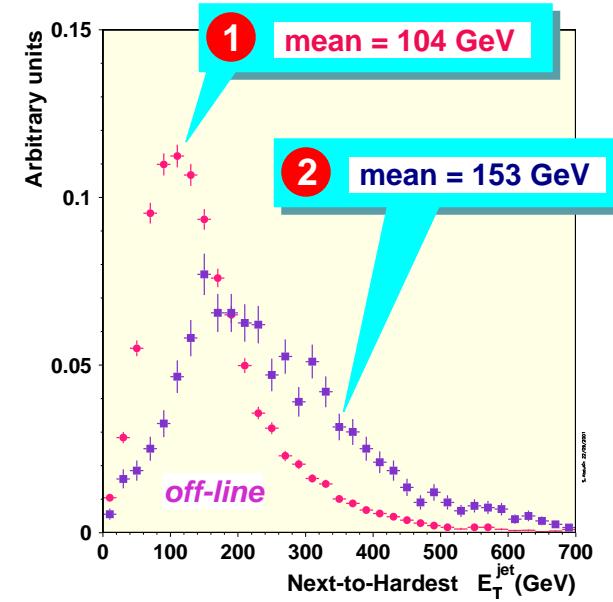
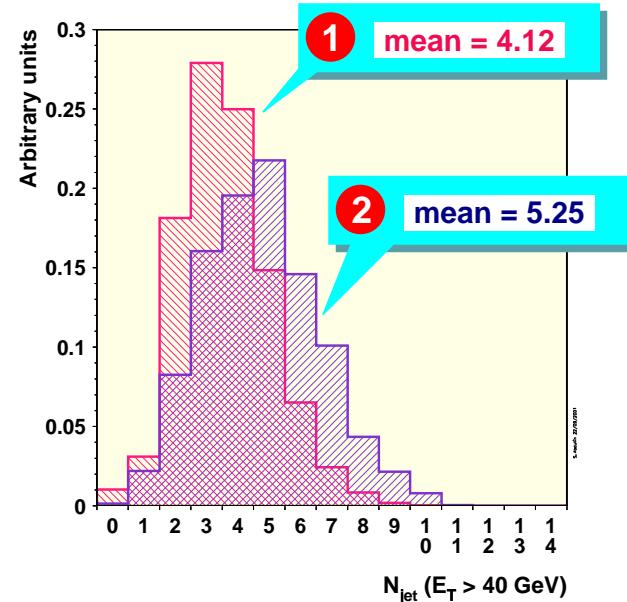
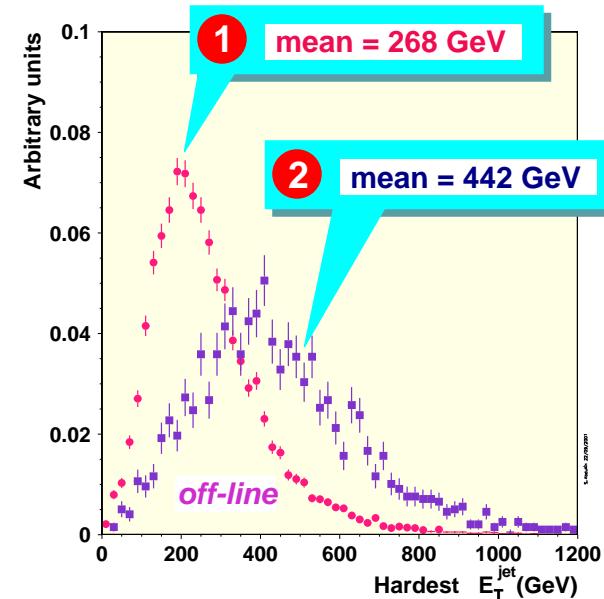
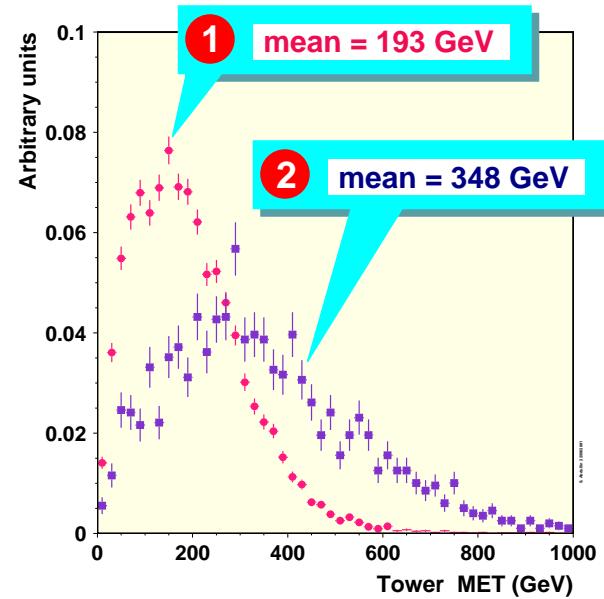
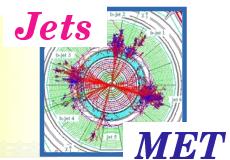
① $E_T > 200 \text{ GeV}, N_j \geq 3$

$E_T^j > 100, 50, 50 \text{ GeV}$

- Typical efficiency for the signal : 20 - 50 % (0.5 - 1 TeV)

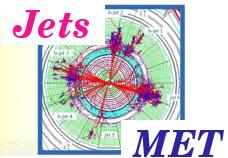


PROBING POINTS DISTRIBUTIONS





CALCULATIONAL DETAILS



■ Jet corrections

- Andrei Kirokhine's for low luminosity
[http://home.fnal.gov/~sceno/jpg/fall20012e33/...](http://home.fnal.gov/~sceno/jpg/fall20012e33/)
- applied to both L1, L2 jets
- Jets corrected: $E_T > 30$ GeV

■ MET corrections

- not applied
- L1 - not quite clear which way it's possible to correct L1 MET ...
- L2 - small effect compared to real MET

■ L1 cuts taken from CMS IN 2001/42 (Wisconsin team)

- nominal 12.5 kHz L1 Trigger rate limit is assumed
- L1 jet cuts : 120, 90, 70, 50 GeV for (respectively) single, double, triple and quadruple jets
- L1 MET cut : 100 GeV (95 % at 275 GeV !)



L1 SIGNAL SELECTION

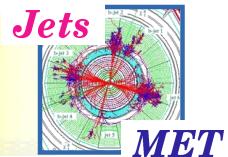


■ Signal cumulative (individual) trigger efficiencies (%)

E_T cut (GeV)		Point 1	Point 2
j	120	91.5 (91.5)	97.5 (97.5)
jj	90	93.3 (81.1)	97.7 (93.1)
jjj	70	93.9 (58.6)	98.2 (81.6)
jjjj	50	94.7 (47.4)	98.4 (71.0)
MET	100	94.9 (67.2)	98.4 (88.3)



BACKGROUND



■ SM background for fairly low SUSY mass scale (0.5-1 TeV) :

- single(Wtb)/double top production,
multijet QCD (incl. $b\bar{b}$ + X),
 $W/Z + \text{multijets}$
- $\left. \begin{array}{l} \text{single(Wtb)/double top production,} \\ \text{multijet QCD (incl. } b\bar{b} + X\text{),} \\ W/Z + \text{multijets} \end{array} \right\} \text{ comparable}$

■ Even 0.1 fb^{-1} would require ($\times 100$ for 10 fb^{-1})

- $Wj \sim 160,000$ events } $\hat{p}_T > 100 \text{ GeV}$
- $Zj \sim 60,000$ events }
- $t\bar{t} \sim 80,000$ events + $\sim 30,000$ for single top ($\sim 47,000$ next week)
- $QCD \sim 7 * 10^6$ events } $\hat{p}_T > 200 \text{ GeV}$ ($\sim 10^6$ available)

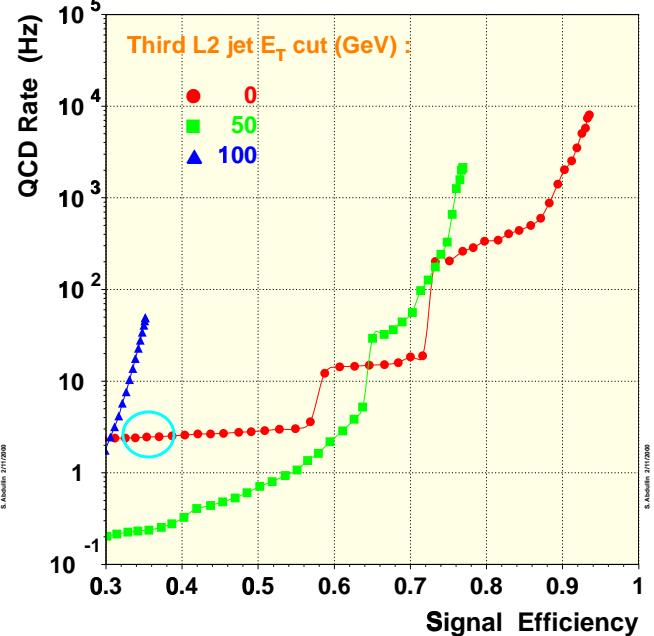
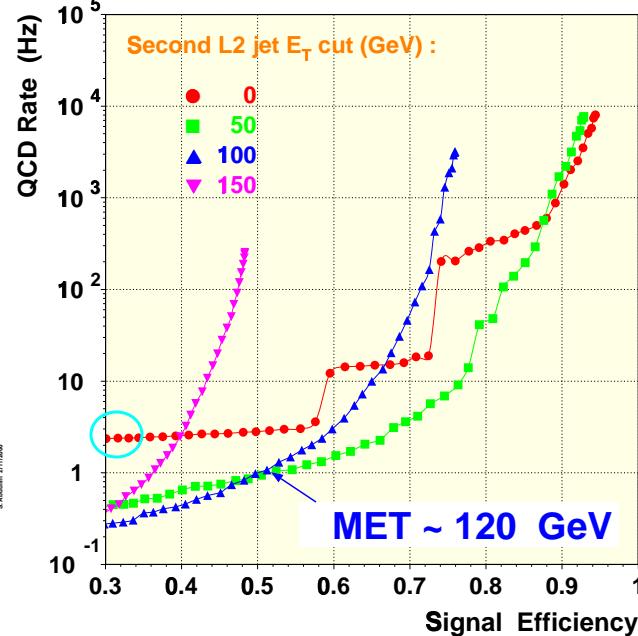
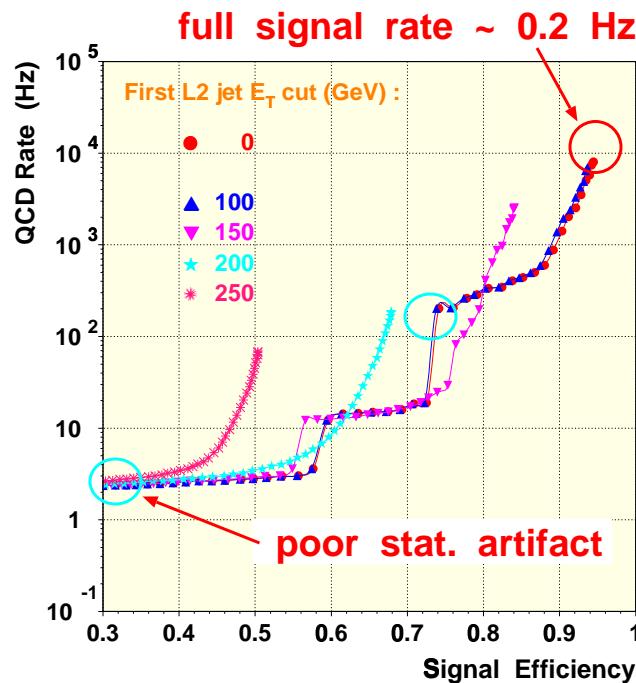
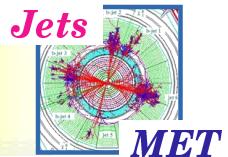
■ Physics TDR challenge ?

■ QCD is the main problem for HLT

- $Wj (\hat{p}_T > 100 \text{ GeV}) : 3.5 \text{ Hz} @ 2e33$
 - $Zj (\hat{p}_T > 100 \text{ GeV}) : 1.3 \text{ Hz} @ 2e33$
 - $t\bar{t}$ (entire sample) : $1.6 \text{ Hz} @ 2e33$
- $\left. \begin{array}{l} \text{ } \\ \text{ } \\ \text{ } \end{array} \right\} \text{total rate w/o selection}$



SIGNAL EFFICIENCY VS QCD RATE AT L2 (I)



Point 1

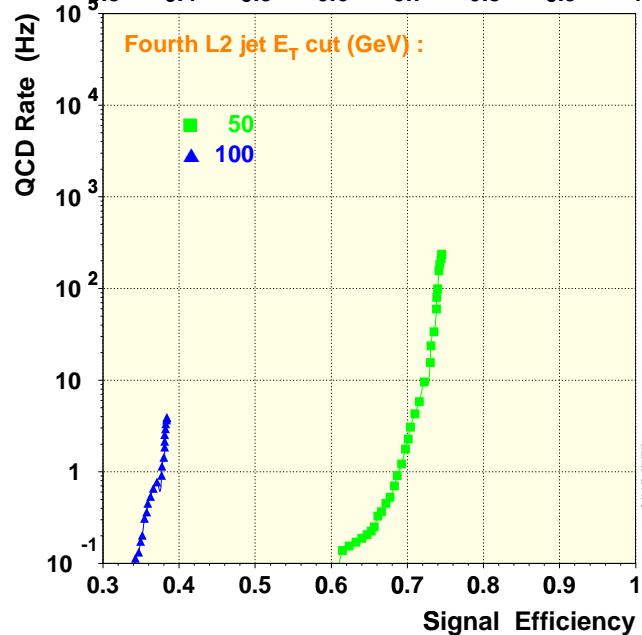
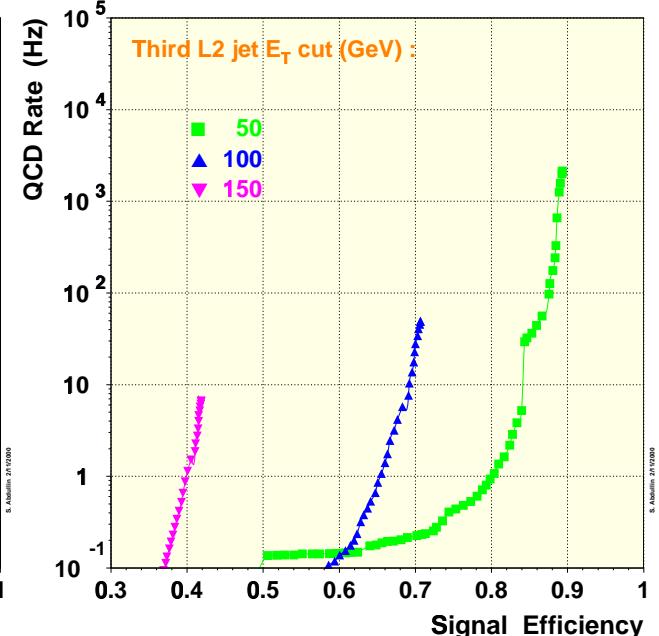
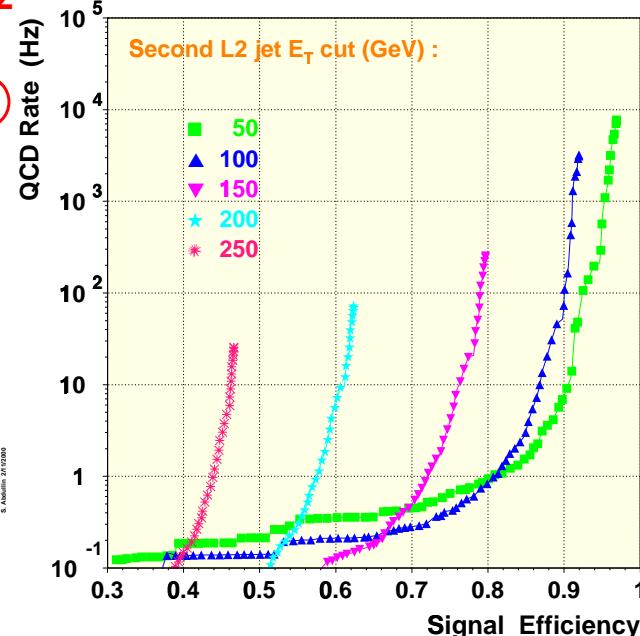
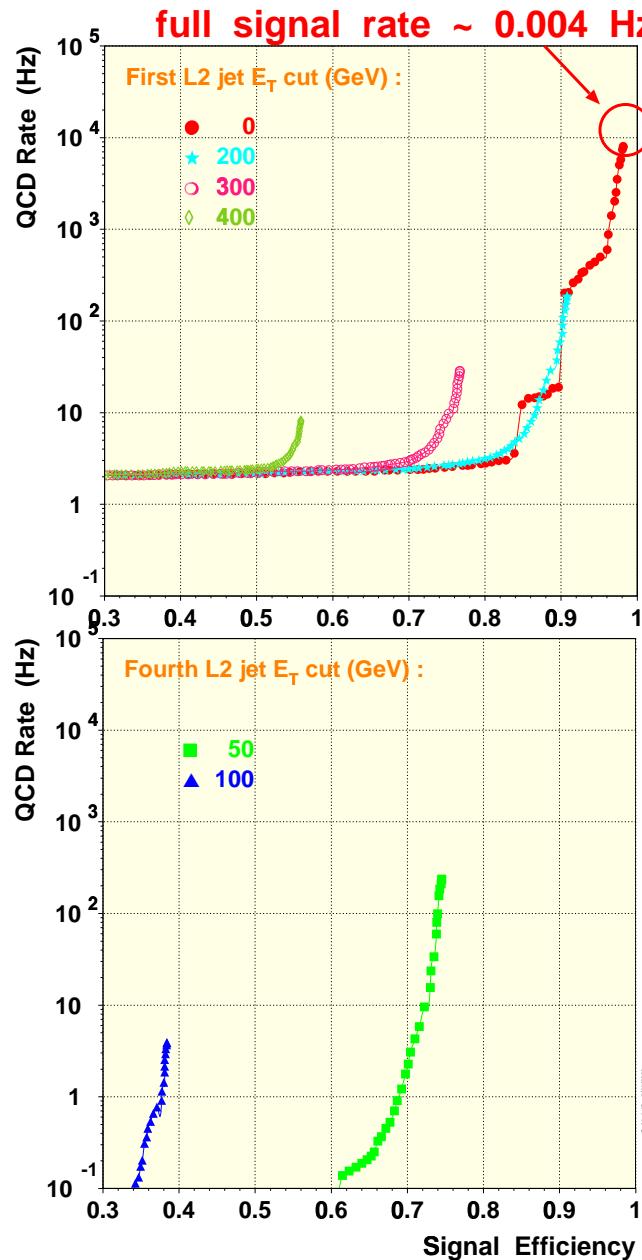
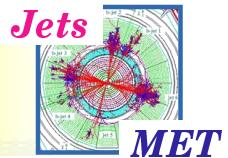


We can preserve $\sim 50\%$ of the signal, while keeping QCD rate at ~ 1 Hz by one of the next requirements :

- 2 jets with $E_T > 100$ GeV + MET > 120 GeV
- 3 jets with $E_T > 50$ GeV + MET > 110 GeV
- MET cut seems to be essential in reducing QCD rate ...



SIGNAL EFFICIENCY VS QCD RATE AT L2 (II)



Point 2

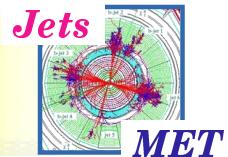


~ 80 % of the signal at ~ 1 Hz QCD rate

- 2 jets with $E_T > 100$ GeV + MET > 120 GeV
- 2 jets with $E_T > 50$ GeV + MET > 160 GeV
- 3 jets with $E_T > 50$ GeV + MET > 110 GeV
- MET cut seems to be essential ...



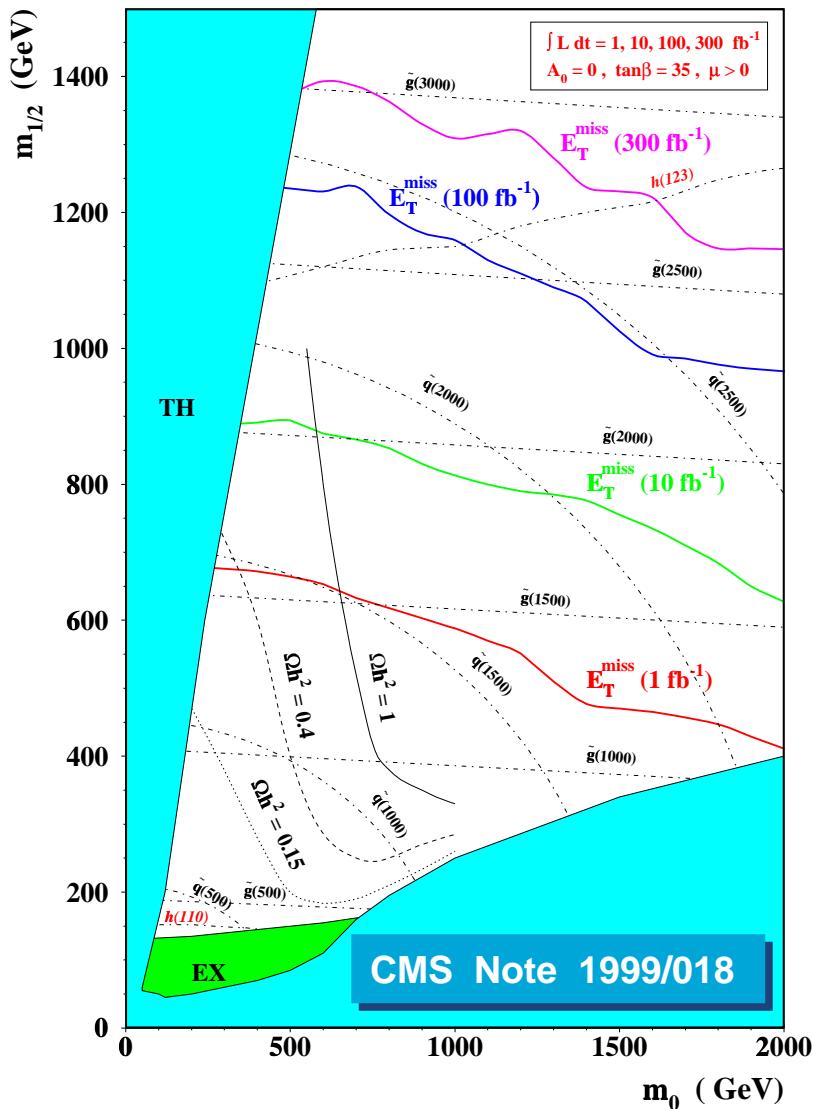
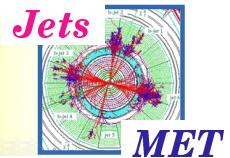
MORE PROBING POINTS ...



- Inclusive SUSY signatures (except some degenerate cases) have a kind of "compensating" effect due to multi-particle cascade decays
 - less jets \rightarrow harder jets
 - missing E_T slightly depends on internal mass hierarchy
(lighter $\tilde{\chi}_1^0 \rightarrow$ more boosted etc.)
- After cuts optimization the observability of inclusive SUSY signal depends mainly on the mass scale of strongly interacting sparticles (squarks and gluino)
- Still $m_0 \ll m_{1/2}$ and vice versa have some particularities
- 3 more points are in production at the moment (hep-ph/0106204)
 - point "B" - less "normal jets", much more taus
 - point "C" - less "normal jets", more sleptons \rightarrow leptons
 - point "E" - more jets, especially b-ones



PLANS



... I like the striking
hugeness of our plans ...

- ☞ Top background to add
- ☞ More signal points ...
- ☞ Optimal combination of 1, 2, 3, ... jets + MET triggers
- ☞ $M_{\text{SUSY}} \sim 2 \text{ TeV}$ is probably reachable already at low lumi ?
According to the LHC plans, 10 fb^{-1} are to be collected in the first 7-months run ...